
NAVFAC IGS-16710 (MAY 2002)

Preparing Activity: LANTNAVFACENGCOM Based on UFGS-16710N

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

SECTION 16710

STRUCTURED TELECOMMUNICATIONS CABLING AND PATHWAY SYSTEM
05/02

NOTE: This guide specification is issued by the
Atlantic Division, Naval Facilities Engineering
Command for regional use in Italy.

NOTE: This guide specification covers requirements
for permanently installed telecommunications cabling
and pathway systems using a physical star network
topology. Telecommunications cabling systems
include the copper and optical fiber horizontal and
interior building backbone systems and cable media,
patch panels, connecting blocks, firestopping,
grounding, cable support, hardware, communications
outlets, connectors, and associated hardware;
station wiring, work area station outlets (jacks);
and distribution terminals. This specification
covers voice and data communications cabling systems
supporting customer's voice, data, video, audio,
security, digital imaging and environmental control
to transport information throughout modern
building's local area network systems using twisted
pair and optical fiber cables.

NOTE: NAVFAC design drawings prepared by A/E or
in-house staff shall provide single line schematic
type diagrams of the telecommunications system, site
plans, and floor plans showing overhead or
underground service entrances, maintenance holes,
handholes, conduit sizes, conductor size and type,
number of pairs and fibers, and physical locations
of telecommunications equipment rooms, main
distribution frames, building distribution frames,
intermediate distribution frames, and
telecommunications outlets. MIL-HDBK-1012/3,
"Telecommunications Premises Distribution Planning,

Design, and Estimating" provides guidance for
interior telecommunications cabling systems.

NOTE: Comments and suggestion on this specification
are welcome and should be directed to the technical
proponent of the specification. A listing of the
technical proponents, including their organization
designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer
choices or locations where text must be supplied by
the designer.

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the
extent referenced. The publications are referred to within the text by the
basic designation only.

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA) / ELECTRONIC
INDUSTRIES ASSOCIATION (EIA)

EIA-310-D	(1992) Cabinets, Racks, Panels, and Associated Equipment (ANSI/EIA/310-D)
TIA-455-21-A	(1988) FOTP-21 - Mating Durability for Fiber Optic Interconnecting Devices
TIA/EIA-492AAAA-A	(1998) 62.5-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (ANSI/TIA/EIA-492AAAA-A)
TIA/EIA-492AAAB	(1998) 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (ANSI/TIA/EIA-492AAAB)
TIA/EIA-492CAAA	Class IVa Dispersion-Unshifted Single-Mode Optical Fibers (ANSI/TIA/EIA-492CAAA)
TIA/EIA-526-7	(1998) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (ANSI/TIA/EIA-526-7)
TIA/EIA-526-14-A	(1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)

TIA/EIA-568-B.1	(2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)
TIA/EIA-568-B.2	(2001) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components (ANSI/TIA/EIA-568-B.2)
TIA/EIA-568-B.3	(2000) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)
TIA/EIA-569-A	(1998; Adenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)
TIA/EIA-570-A	(1999) Residential Telecommunications Cabling Standard (ANSI/TIA/EIA-570-A)
TIA/EIA-606	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings (ANSI/TIA/EIA-606)
TIA/EIA-607	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications (ANSI/TIA/EIA-607)

EUROPEAN COMMUNITY QUALITY MARKS (CE)

NOTE: CE (European Community) is a European quality marking system indicating that the equipment or product conforms to EEC (European Economic Community) standards concerning quality of safety and health and conforms with all the Italian technical standards in force. All products (Electrical, Mechanical and Electronic Equipment and similar items) that are marked CE conform to the standards and Laws enforced in Europe. In Italy, the CE marking is a mandatory requirement and must be shown on all applicable equipment and products attesting to the conformity with the EEC standards.

CE	Quality Mark
----	--------------

ITALIAN ELECTROTECHNICAL COMMITTEE STANDARDS (CEI)

NOTE: A CEI Norm is an Italian technical normative for electrical systems recognized by Italian Law,

submitted by a private organization "Comitato
Elettrotecnico Italiano" for the Italian
territory, available in the Italian language and
only in some cases in English.

CEI 20-22/2	(1999) Tests on electric cables under fire conditions - Part 2: Fire propagation
CEI 20-37/1	(1997) Tests on gases evolved during combustion of electric cables and their compounds - Part 1: Scope and general requirements
CEI 64-8	(1998) Electrical installations of buildings
CEI 103-1/12	(1997) Private telephone exchanges - Part 12: Protection of the private telephone exchanges

ITALIAN/EUROPEAN HARMONIZATION STANDARDS (UNI EN)(UNI ENV)(CEI EN)
(UNI EN ISO)(UNI ISO)

NOTE: A UNI EN, UNI ENV, CEI EN, UNI EN ISO or UNI ISO is a European Standard with a coincident Italian National Standard or International Standard. The two standards are identical, with most (but not all) EN's available in the English language and the UNI available only in the Italian language.

CEI EN 50265-1	(1999) Common test methods for cables under fire conditions - Test for resistance to vertical flame propagation for a single insulated conductor or cable - Part 1: Apparatus
CEI EN 50265-2-1	(1999) Common test methods for cables under fire conditions - Test for resistance to vertical flame propagation for a single insulated conductor or cable - Part 2-1: Procedures - 1 kW Pre-mixed Flame
CEI EN 50265-2-2	(1999) Common test methods for cables under fire conditions - Test for resistance to vertical flame propagation for a single insulated conductor or cable - Part 2-2: Procedures - Diffusion Flame
CEI EN 50266-1	(2001) Common test methods for cables

	under fire conditions - Test for vertical flame spread of vertically-mounted bunched wires or cables - Part 1: Apparatus
CEI EN 50266-2-1	(2001) Common test methods for cables under fire conditions - Test for vertical flame spread of vertically-mounted bunched wires or cables - Part 2-1: Procedures - Category A F/R
CEI EN 50266-2-2	(2001) Common test methods for cables under fire conditions - Test for vertical flame spread of vertically-mounted bunched wires or cables - Part 2-2: Procedures - Category A
CEI EN 50266-2-3	(2001) Common test methods for cables under fire conditions - Test for vertical flame spread of vertically-mounted bunched wires or cables - Part 2-3: Procedures - Category B
CEI EN 50266-2-4	(2001) Common test methods for cables under fire conditions - Test for vertical flame spread of vertically-mounted bunched wires or cables - Part 2-4: Procedures - Category C
CEI EN 50266-2-5	(2001) Common test methods for cables under fire conditions - Test for vertical flame spread of vertically-mounted bunched wires or cables - Part 2-5: Procedures - Category D

1.2 RELATED REQUIREMENTS

Section 16050, "Basic Electrical Materials and Methods," Section 16402, "Interior Distribution System," and Section 16721, "Telephone Distribution System, Outside Plant," apply to this section with additions and modifications specified herein.

1.3 DEFINITIONS

1.3.1 Main Distribution Frame (MDF)

A physical structure at a central location for terminating permanent backbone cables to interconnect with service provider (SP) equipment at the activity minimum point of presence. The MDF generally includes vendor specific components to support voice and data circuits, building surge protector assemblies, main cross connect blocks, equipment support frames, and wood backboard (if MDF is wall mounted). Depending upon local site conditions, the MDF and BDF may be identical.

1.3.2 Building Distribution Frame (BDF)

A structure with terminations for connecting backbone, campus, and horizontal cabling. The BDF generally includes a cross connect, equipment support frame, and wooden backboard or terminal cabinet. The BDF shall include building protector assemblies when used for campus backbone or SP cabling.

1.3.3 Intermediate Distribution Frame (IDF)

An intermediate termination point for horizontal wiring and cross connections within telecommunications closets or wiring closets.

1.3.4 Telecommunications Closet

An enclosed space for telecommunications equipment, terminations, and cross-connect wiring for horizontal cabling.

1.4 SYSTEM DESCRIPTION

NOTE: Refer to Section 16721, "Telephone Distribution System, Outside Plant" for exterior distribution and interbuilding cables and additional requirements for service entrance facilities.

The structured telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting. The horizontal system includes the cabling and pathway between the telecommunications closet and the work area telecommunications outlet. The horizontal system shall be wired in a star topology with the IDF at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware to provide connectivity between the MDF's, BDF's, and IDF's. The backbone system shall be wired in a star topology with the MDF at the center or hub of the star.

1.5 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item is required.
A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the

submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Recommended codes for Army projects are "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Telecommunications drawings; G

Distribution frames; G

SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G

Patch panels; G

Telecommunications outlet/connector assemblies; G

Equipment support frame; G

Building protector assemblies; G

Connector blocks; G

Protector modules; G

SD-06 Test Reports

Telecommunications cabling testing; G

[Factory reel tests;] G

[Furnish factory reel tests for optical fiber cables.]

SD-07 Certificates

Installer qualifications; G

Test plan; G

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5; G

Submit operations and maintenance data in accordance with Section 01781, "Operation and Maintenance Data" and as specified herein.

1.6 ADDITIONAL SUBMITTAL REQUIREMENTS

1.6.1 Telecommunications Drawings

NOTE: Require Certified Italian Engineer/Technician approved drawings for designs with more than one telecommunications closet and designs that have multiple voice and data systems.

Provide [Certified Italian Engineer/Technician approved] drawings complete with wiring diagrams and details required to prove that the distribution system shall properly support connectivity from the telecommunications equipment room to telecommunications work area outlets. Show the entrance facility and layout of cabling and pathway runs, cross connect points, MDF, BDF, IDF, grounding system, terminating block arrangements and type. Drawings shall depict final telecommunications cabling configuration, including location, color coding, gage, pair assignment, polarization, and terminating blocks layout at cross connect points and patch panels after telecommunications cable installation. Provide a plastic laminated schematic of telecommunications cable system showing cabling, BDF's, IDF's, MDF's, and equipment rooms keyed to floor plans by room number.

1.6.2 Distribution Frames

Provide shop drawing showing layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks and equipment spaces and racks.

1.6.3 Installer Qualifications

Prior to installation, submit data of installer's experience and qualifications. Installers shall have experience which shall include 3 years on projects of similar complexity. Include names and locations of two projects successfully completed using [optical fiber and] copper communications cabling systems. Include written certification from users that systems have performed satisfactorily for not less than 18 months. Include specific experience in installing and testing structured telecommunications distribution systems using [optical fiber,] [Category 3] [and] [Category 5e] cabling systems.

1.6.4 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the [UTP] [optical fiber] components and accessories. Include procedures for certification, validation, and testing.

1.6.5 Additions to Operation and Maintenance Manuals

In addition to requirements of Data package 5 for the telecommunications cabling and pathway system, include the requirements of paragraph entitled "Telecommunications Drawings."

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, dirt, dust, and other contaminants for telecommunications cabling and pathway equipment placed in storage.

PART 2 PRODUCTS

2.1 SOURCE MANUFACTURERS

2.1.1 Cabling

The following manufacturers provide telecommunications cabling (backbone and horizontal) that generally comply with these specifications:

BICC Cables S.A.
Parc d'activites des Beaux Soleils
Immeuble "Le Vecteur"
2 av- des Arpents
95520 Osny
FRANCE
Tel: 34 24 86 86
Fax: 30 73 24 60

Krone Italia, s.r.l.
Sede Legale ed Amministrativa
Via Oliviero Petronio, 11
34015 Muggia, Trieste
Tel: (040) 232346
Fax: (040) 231931
Web Site: www.krone.it

Lucent Technologies Italia S.p.A.
Via Cesare Giulio Viola, 65
00148 Parco dei Medici, Roma
Tel: +39-06-65182.1
Fax: +39-06-65182.423
Web Site: www.lucent.it

VIMAR
Via IV Novembre 32

36063 Marostica (VI)
Tel: (0424) 488100
Web Site: www.vimar.it

2.1.2 Patch Panels

The following manufacturers provide patch panels that generally comply with these specifications:

Bticino S.p.A.
Via Messina, 38
20154 Milano
Web Site: www.bticino.it

Krone Italia, s.r.l.
Sede Legale ed Amministrativa
Via Oliviero Petronio, 11
34015 Muggia, Trieste
Tel: (040) 232346
Fax: (040) 231931
Web Site: www.krone.it

PANDUIT s.r.l.
Via Como 10
Milano, Linate I-20020
Tel: + 39 02 931 731
Fax: + 39 02 935 70333
Web Site: www.panduit.com

VIMAR
Via IV Novembre. 32
36063 Marostica (VI)
Tel: (0424) 488100
Web Site: www.vimar.it

2.1.3 Outlet/Connector Assemblies

The following manufacturers provide telecommunications outlet/connector assemblies that generally comply with these specifications:

Bticino S.p.A.
Via Messina, 38
20154 Milano
Web Site: www.bticino.it

Krone Italia, s.r.l.
Sede Legale ed Amministrativa
Via Oliviero Petronio, 11
34015 Muggia, Trieste
Tel: (040) 232346
Fax: (040) 231931
Web Site: www.krone.it

Lucent Technologies Italia S.p.A.

Via Cesare Giulio Viola, 65
00148 Parco dei Medici, Roma
Tel: +39-06-65182.1
Fax: +39-06-65182.423
Web Site: www.lucent.it

PANDUIT s.r.l.
Via Como 10
Milano, Lianate I-20020
Tel: + 39 02 931 731
Fax: + 39 02 935 70333
Web Site: www.panduit.com

VIMAR
Via IV Novembre. 32
36063 Marostica (VI)
Tel: (0424) 488100
Web Site: www.vimar.it

2.1.4 Equipment Support Frames

The following manufacturers provide equipment support frames that generally comply with these specifications:

Krone Italia, s.r.l.
Sede Legale ed Amministrativa
Via Oliviero Petronio, 11
34015 Muggia, Trieste
Tel: (040) 232346
Fax: (040) 231931
Web Site: www.krone.it

Legrand Italia
ZIBIDO S. GIACOMO (MI)
S.S. 35 dei Giovi km 108
CAP 20080
Tel: 02. 900 281
Fax: 02. 900 28 688
Web Site: www.legrand.it

PANDUIT s.r.l.
Via Como 10
Milano, Lianate I-20020
Tel: + 39 02 931 731
Fax: + 39 02 935 70333
Web Site: www.panduit.com

2.1.5 Protector Assemblies

The following manufacturers provide building protector assemblies that generally comply with these specifications:

Krone Italia, s.r.l.
Sede Legale ed Amministrativa

Via Oliviero Petronio, 11
34015 Muggia, Trieste
Tel: (040) 232346
Fax: (040) 231931
Web Site: www.krone.it

Lucent Technologies Italia S.p.A.
Via Cesare Giulio Viola, 65
00148 Parco dei Medici, Roma
Tel: +39-06-65182.1
Fax: +39-06-65182.423
Web Site: www.lucent.it

2.1.6 Connector Blocks

The following manufacturers provide connector blocks that generally comply with these specifications:

Krone Italia, s.r.l.
Sede Legale ed Amministrativa
Via Oliviero Petronio, 11
34015 Muggia, Trieste
Tel: (040) 232346
Fax: (040) 231931
Web Site: www.krone.it

Lucent Technologies Italia S.p.A.
Via Cesare Giulio Viola, 65
00148 Parco dei Medici, Roma
Tel: +39-06-65182.1
Fax: +39-06-65182.423
Web Site: www.lucent.it

PANDUIT s.r.l.
Via Como 10
Milano, Linate I-20020
Tel: + 39 02 931 731
Fax: + 39 02 935 70333
Web Site: www.panduit.com

2.1.7 Connector Protector Modules

The following manufacturers provide connector protector modules that generally comply with these specifications:

Krone Italia, s.r.l.
Sede Legale ed Amministrativa
Via Oliviero Petronio, 11
34015 Muggia, Trieste
Tel: (040) 232346
Fax: (040) 231931
Web Site: www.krone.it

Lucent Technologies Italia S.p.A.

Via Cesare Giulio Viola, 65
00148 Parco dei Medici, Roma
Tel: +39-06-65182.1
Fax: +39-06-65182.423
Web Site: www.lucent.it

2.2 COMPONENTS

NOTE: Refer to Section 16402, "Interior Distribution System" for interior conduit system requirements and Section Section 16303, "Underground Electrical Work" for service entrance, backbone, and horizontal pathway and cable systems.

Provide a complete system of telecommunications cabling and pathway components using star topology and support structures, pathways, and spaces complete with conduits, pull wires, wireways, cable trays, terminal boxes, outlets, cables, junction boxes, telephone cabinets, and telecommunications closets. Fixed cables and pathway systems for telecommunications systems shall comply with CEI 64-8.

2.2.1 CE Marking and Display

Equipment, materials, components, assemblies and so forth which are subject to European Union (EU) economic directives shall have an approved Declaration of Conformity as demonstrated by an authorized display of the CE Mark (Conformite Europeenne Mark). The CE Mark logo shall be placed on the product, the product literature, and/or packaging as required by the respective EU directive, or directives.

2.3 PATHWAYS (BACKBONE AND HORIZONTAL)

NOTE: Refer to Section 16130, "Underfloor Raceway System" for underfloor duct systems.

TIA/EIA-569-A. Pathway shall be [conduit,] [cable tray,] [underfloor duct,] [access floor,] and [wireway] installations. Provide grounding and bonding as required by TIA/EIA-607. [Cable tray wiring shall comply with CEI 64-8.]

2.3.1 Work area Pathways

Comply with TIA/EIA-569-A. System furniture pathways shall comply with CEI 20-22/2, CEI EN 50265-1, CEI EN 50265-2-1, CEI EN 50265-2-2, CEI EN 50266-1, CEI EN 50266-2-1, CEI EN 50266-2-2, CEI EN 50266-2-3, CEI EN 50266-2-4, CEI EN 50266-2-5, and CEI 20-37/1 as applicable.

2.4 TELECOMMUNICATIONS CABLING

NOTE: Cables shall be terminated within telecommunications closets, telecommunications equipment rooms, and workstations. Cross connect jumpers may be provided as part of the contract if required to provide the customer a complete and usable facility. Optical fiber and copper patch cords shall be provided by the Contractor when patch panels are installed. Recommend using patch cords with "Push/Pull" connectors. Cross connect patch cords shall meet minimum performance requirements specified in EIA/TIA-568-B.1, EIA/TIA-568-B.2, and EIA/TIA-568-B.3 for cables and hardware specified. Patch cords should not exceed 20 meter 66 feet. Optical fiber media may be single mode, multimode, or hybrid combination. Typically for interbuilding backbone applications specify multimode. For additional technical information on optical fiber cabling, contact www.corningfiber.com. For information on optical fiber local area network system, visit www.industry.net/TIA.

Cabling shall be CE listed for the application and shall comply with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3]. Provide a labeling system for cabling as required by TIA/EIA-606. Cabling manufactured more than 12 months prior to date of installation shall not be used.

[2.4.1 Backbone Cabling

NOTE: 150 ohm shielded twisted pair should not be used for new construction. Specifications are not included due to limited applications. Backbone cable lengths shall not exceed guidelines of EIA/TIA-568-B.1, and EIA/TIA-568-B.2. S/UTP 100 ohm backbone and horizontal cable may be required for EMI isolation in complex buildings. Enhanced Category 5 backbone cable is typically only available in 25 pair. For facilities with multiple communication closets, consideration should be given to providing an optical fiber backbone for the data system.

NOTE: When optical fiber connectivity is required to the desktop for IT-21 applications, a minimum of four strands of 62.5/125 um multimode fiber media shall be provided with two four pair of copper media. Utilize type SC fiber connectors for all new fiber installations. ST fiber connectors should only be considered in existing facilities where ST fiber connectors are used. Wire all RJ-45 jacks and receptacles to 568A configuration unless

specifically requested otherwise. Do not exceed
cable manufacturer's specific minimum bend radius or
manufacturer's maximum pull tension (tensile) rating.

[2.4.1.1 Backbone Copper

TIA/EIA-568-B.1, TIA/EIA-568-B.2 and CEI 20-22/2. Copper backbone cable shall be solid conductor, 24 AWG, 100 ohm, [100][____]-pair UTP (Unshielded twisted pair), riser CMR rated formed into 25 pair binder groups covered with a gray thermoplastic jacket[and metallic shield]. [Plenum rated cable may be substituted for riser cable.]Pair twist lengths and frequency per unit length shall be determined by the manufacturer. A minimum of two conductor twists per 300 mm is required. Color coding shall comply with industry standards for 25 pair cables. [Cable shall be third party verified to comply with EIA/TIA [Category 3] [and] [Category 5e] requirements.]

]2.4.1.2 Backbone Optical Fiber

[TIA/EIA-492AAAB, TIA/EIA-568-B.3, CEI 20-22/2, CEI EN 50265-1, CEI EN 50265-2-1, CEI EN 50265-2-2, CEI EN 50266-1, CEI EN 50266-2-1, CEI EN 50266-2-2, CEI EN 50266-2-3, CEI EN 50266-2-4, CEI EN 50266-2-5, and CEI 20-37/1 as applicable. Optical fiber cable shall be 50/125-um, [24][____]-fiber multimode, with a nonconductive optical fiber riser cable (OFNR) rating. Nonconductive optical fiber riser cable may be substituted for type nonconductive optical fiber plenum cable (OFNP). The cable jacket shall be orange.]

[TIA/EIA-492AAAA-A, TIA/EIA-568-B.3, CEI 20-22/2, CEI EN 50265-1, CEI EN 50265-2-1, CEI EN 50265-2-2, CEI EN 50266-1, CEI EN 50266-2-1, CEI EN 50266-2-2, CEI EN 50266-2-3, CEI EN 50266-2-4, CEI EN 50266-2-5, and CEI 20-37/1 as applicable. Optical fiber cable shall be 62.5/125-um, [24][____]-fiber multimode, with a nonconductive optical fiber riser cable (OFNR) rating. Nonconductive optical fiber riser cable may be substituted for type nonconductive optical fiber plenum cable (OFNP). The cable jacket shall be orange.]

[TIA/EIA-492CAAA, TIA/EIA-568-B.3, CEI 20-22/2, CEI EN 50265-1, CEI EN 50265-2-1, CEI EN 50265-2-2, CEI EN 50266-1, CEI EN 50266-2-1, CEI EN 50266-2-2, CEI EN 50266-2-3, CEI EN 50266-2-4, CEI EN 50266-2-5, and CEI 20-37/1 as applicable. Optical fiber cable shall be 8/125-um, [24][____]-fiber single-mode, with a nonconductive optical fiber riser cable (OFNR) rating. Nonconductive optical fiber riser cable may be substituted for type nonconductive optical fiber plenum cable (OFNP). The cable jacket shall be orange.]

**NOTE: Provide plenum rated cabling in ducts,
plenums and other air-handling spaces.**

]2.4.2 Horizontal Cabling

Comply with CEI 64-8 and performance characteristics in TIA/EIA-568-B.1.

2.4.2.1 Horizontal Copper

TIA/EIA-568-B.2, CEI 20-22/2, UTP (unshielded twisted pair), 100 ohm. Provide four each individually twisted pair, [24 AWG] [22 AWG] conductors, [Category 3] [and] [Category 5e] [general purpose][plenum] rated, with a blue PVC jacket. [Plenum or riser cable may be substituted for general purpose cable.] [Residential Category 3 cable shall comply with TIA/EIA-570-A.]

[2.4.2.2 Horizontal Optical Fiber

[TIA/EIA-492AAAB, TIA/EIA-568-B.3, CEI 20-22/2, CEI EN 50265-1, CEI EN 50265-2-1, CEI EN 50265-2-2, CEI EN 50266-1, CEI EN 50266-2-1, CEI EN 50266-2-2, CEI EN 50266-2-3, CEI EN 50266-2-4, CEI EN 50266-2-5, and CEI 20-37/1 as applicable. Optical fiber cable shall be 50/125-um, 2-fiber multimode, rated [nonconductive optical fiber general purpose cable (OFN)] [nonconductive optical fiber riser cable (OFNR)] [nonconductive optical fiber plenum cable (OFNP)]. [Type OFNP or Type OFNR may be substituted for type OFN.] The cable jacket shall be orange and be of single jacket construction.]

[TIA/EIA-492AAAA-A, TIA/EIA-568-B.3, CEI 20-22/2, CEI EN 50265-1, CEI EN 50265-2-1, CEI EN 50265-2-2, CEI EN 50266-1, CEI EN 50266-2-1, CEI EN 50266-2-2, CEI EN 50266-2-3, CEI EN 50266-2-4, CEI EN 50266-2-5, and CEI 20-37/1 as applicable. Optical fiber cable shall be 62.5/125-um, 2-fiber multimode, rated [nonconductive optical fiber general purpose cable (OFN)] [nonconductive optical fiber riser cable (OFNR)] [nonconductive optical fiber plenum cable (OFNP)]. [Type OFNP or Type OFNR may be substituted for type OFN.] The cable jacket shall be orange and be of single jacket construction.]

]2.5 DISTRIBUTION FRAMES

Provide building distribution frames (BDF's), intermediate distribution frames (IDF's), and main distribution frames (MDF's) as shown on design drawings for terminating and cross connecting permanent cabling.

NOTE: Provide equipment support frames only when patch panels are provided. In most applications, a rack in locked communications closet is sufficient. Provide lockable cabinets in locations where additional security is required. Use wall-mounted brackets for small systems where only a few patch panels are required.

[2.5.1 Equipment Support Frame

EIA-310-D and shall be CE listed for the application.

[a. Bracket, wall mounted, 4 mm aluminum. Provide hinged bracket

compatible with 490 mm panel mounting.]

[b. Racks, floor mounted modular type, 1.5 mm steel construction treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug[and a surge protected power strip with 6 duplex 16 amp receptacles]. Rack shall be compatible with 490 mm panel mounting.]

[c. Cabinets, freestanding modular type, 1.5 mm steel construction treated to resist corrosion. Cabinet shall have removable and lockable side panels, front and rear doors, and have adjustable feet for leveling. Cabinet shall be vented in the roof and rear door. Cabinet shall have cable access in the roof and base and be compatible with 490 mm panel mounting. Provide cabinet with grounding bar[,][rack mounted 15 cu. m per minute fan with filter and a surge protected power strip with 6 duplex 16 amp receptacles]. [All cabinets shall be keyed alike.]]

[d. Cabinets, wall-mounted modular type, 1.5 mm steel construction treated to resist corrosion. Cabinet shall have have lockable front and rear doors, louvered side panels,[7 cu. m per minute roof mounted fan,] ground lug, and top and bottom cable access. Cabinet shall be compatible with 490 mm panel mounting. [All cabinets shall be keyed alike.]]

]2.5.2 Building Protector Assemblies

Self-contained unit providing a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for [_____] pairs of outside cable. Building protector assembly shall be CE listed for the application and shall have connector blocks for connection to interior cabling at full capacity.

2.5.2.1 Protector Modules

CEI 103-1/12, three-electrode gas tube or solid state type rated for the application. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.5.3 Connector Blocks

Insulation displacement [Type 66 for Category 3] [Type 110 for Category 5e and higher] systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare. Connector blocks shall be CE listed for the application.

[2.5.4 Patch Panels

Provide ports for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide pre-connectorized [optical fiber] [and] [copper] patch cords for patch panels. Provide patch cords with connectors specified. Patch cords shall meet minimum performance requirements specified in TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [

TIA/EIA-568-B.3] for cables and hardware specified. Patch panels shall be CE listed for the application

2.5.4.1 Modular to 110 Block Patch Panel

TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3]. Panels shall be third party verified and [shall comply with EIA/TIA [Category 3] [and] [Category 5e] requirements.] [Panels provided for Category 5e UTP cabling shall meet or exceed the requirements for the cable provided.] Panel shall be constructed of 2.2 mm minimum aluminum and shall be compatible with an EIA 490 mm equipment rack. Panel shall provide [48] [_____] non-keyed, RJ-45 ports, wired to [T568A] [or] [T568B] [as indicated]. Patch panels shall terminate the building cabling on 110-style insulation displacement connectors and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

NOTE: Provide patch panels with 24 duplex SC adapters or 48 ST adapters. Larger patch panels cross connect fields are harder to manage. Indicate zirconia ceramic for SC type adapters and connectors and metallic for ST type.

[2.5.4.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 2.2 mm minimum aluminum and shall be compatible with a EIA 490 mm equipment rack. Each panel shall provide [24] [_____] [duplex SC] [ST] [multimode] [and] [single-mode] adapters. Adapters shall utilize [zirconia ceramic] [metallic] alignment sleeves. Provide dust cover for all unused adapters. The rear of each panel shall have a cable management tray a minimum of 200 mm deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

]2.6 TELECOMMUNICATIONS OUTLET BOXES

NOTE: Handicapped telecommunications receptacles shall be mounted at 1400 mm for side reach and 1200 mm for forward reach.

Standard type 90 mm square by 45 mm deep. Mount flush in finished walls at height [indicated] [specified for outlet receptacles]. [Outlet boxes for wall-mounted telephones shall be 90 by 90 by 45 mm deep; mounted at height [1525 mm above finished floor] [as indicated].] [Outlet boxes for handicapped telephone station shall be 90 by 90 by 45 mm deep and mounted at a height [1200 mm above finished floor] [as indicated].] Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend

radii.

2.7 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

NOTE: When a building has elevators, a four-pair copper cable with an eight-position modular outlet shall be installed for each elevator. The exact location of the jack should be verified with the elevator installer or Contractor.

Conduit bend radius shall be coordinated with cable bend radius. Conduit entries at outlet and junction boxes shall be arranged so that cables passing through the box shall enter and exit at opposite sides of the box. Provide grounding and bonding as required by EIA/TIA-607.

NOTE: Data outlets may require 568B or alternate connector configurations to accept customer terminal equipment cords. Wire all RJ-45 jacks and receptacles to 568A configuration unless specifically requested otherwise. RJ-45 modular adapters for 10 base-T or token ring networks are commercially available.

2.7.1 Outlet/Connector Copper

Outlet/connectors shall comply with TIA/EIA-568-B.1, and TIA/EIA-568-B.2. UTP Outlet/connectors shall be non-keyed, 4-pair, constructed of high impact rated thermoplastic housing and shall be third party verified [and shall comply with EIA/TIA [Category 3] [and] [Category 5e] requirements]. [Outlet/connectors provided for Category 5e UTP cabling shall meet or exceed the requirements for the cable provided.] Outlet/connectors shall be terminated using a 110-style PC board connector, color-coded for both T568A and T568B wiring. Each jack shall be wired [T568A] [or] [T568B] [as indicated]. UTP outlet/connectors shall comply with TIA-455-21-A for [500] [_____] mating cycles. [UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound.]

[2.7.2 Optical Fiber Adapters

Optical fiber adapters shall be suitable for [duplex SC] [ST] style connectors. Adapters shall utilize [zirconia ceramic] [metallic] alignment sleeves. Provide dust cover for all adapters.

]2.7.3 Cover Plates

Telecommunications cover plates shall comply with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3]; [flush] [or] [oversized] design

constructed of [high impact thermoplastic,] [stainless steel] [or] [brass] material. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process.

[2.7.4 Optical Fiber Distribution Panel

Wall mounted optical fiber distribution panel (OFDP) shall be constructed of 2.2 mm minimum anodized aluminum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides and shall be lockable, user section shall have a cover for patch cord protection. Each panel shall provide [6] [_____] [duplex SC] [ST] adapters. Adapters shall utilize [zirconia ceramic] [metallic] alignment sleeves. Provide dust covers for all adapters.

]2.7.5 Optical Fiber Connectors

TIA-455-21-A. [Optical fiber connectors shall be [duplex SC] [ST], epoxyless crimp style. The connectors shall utilize a zirconia ceramic ferrule. The connectors shall provide a maximum attenuation of 0.3 dB at 1300 nm with less than a 0.2 dB change after 500 mating cycles.]

2.8 BACKBOARDS

Provide void-free, fire rated or painted interior grade plywood 19 mm thick [1200 by 2400 mm] [as indicated]. Backboards that are not fire rated shall be painted with a gray, nonconductive fire-resistant overcoat. Do not cover the fire stamp on the backboard.

2.9 TERMINAL CABINETS

Terminal cabinets shall be CE listed for the application. Construct of zinc-coated sheet steel, [915 by 610 by 150 mm deep] [as indicated]. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 16 mm backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with lighting panelboards. Provide label and identification systems for telecommunications wiring consistent with TIA/EIA-606.

NOTE: Indicate grounding and bonding components on drawings, indicate the size of all grounding and bonding conductors. For facilities with a lightning protection system, refer to CEI 81-1 "Lightning Protection of Structures" for Additional Requirements.

2.10 GROUNDING AND BONDING PRODUCTS

Comply with CEI 64-8 and, TIA/EIA-607. Components shall be identified as required by TIA/EIA-606. Ground rods shall be in accordance with Section 16402, "Interior Distribution System."

2.11 FIRESTOPPING MATERIAL

**NOTE: Refer to Section 07840, "Firestopping" for
firestopping material requirements.**

Provide in accordance with Section 07840, "Firestopping."

PART 3 EXECUTION

3.1 INSTALLATION

Telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware shall be installed in accordance with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3], TIA/EIA-569-A, and CEI 64-8 as applicable. Cabling shall be connected in a star topology network. [Residential cabling shall be connected in a star wiring architecture from the distribution device as required by TIA/EIA-570-A.] Metal raceway bases, covers, and dividers shall be bonded and grounded in accordance with TIA/EIA-607. Telecommunications cabling and pathways with copper media shall be installed in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling. Pathways shall be installed in accordance with the following minimum clearance distances of 1.2 meters from motors, generators, frequency converters, transformers, x-ray equipment or uninterruptible power system, 300 mm from power conduits and cable systems, 125 mm from fluorescent or high frequency lighting system fixtures.

3.1.1 Cabling

Install [Category 3 UTP] [Category 5e UTP] [optical fiber] telecommunications cabling and pathway system as detailed in TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3] [and TIA/EIA-570-A for residential cabling]. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 5e UTP cables more than 12 mm from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 3 m in the telecommunications closet, [1 m in the work area outlet for optical fiber and] 30 cm for UTP. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 110 N pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter.

[3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors. Comply with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [

TIA/EIA-568-B.3]. Do not exceed cable pull tensions recommended by the manufacturer.

- a. Plenum cable shall be used where open cables are routed through plenum areas. [All cable routed exposed under raised floors shall be plenum rated.] Plenum cables shall comply with flammability plenum requirements of CEI 64-8 and CEI 20-22/2.

]3.1.1.2 Backbone Cable

NOTE: Building entrance backbone cabling is the cable (optical fiber and copper) media between the base backbone distribution cable plant and the telecommunications equipment room or the first terminating point in a building. Cable may be direct buried, aerial, or underground (in conduit and ducts). The preferred method is underground with the cable terminating in the telecommunications equipment room. Conduits and ducts shall be constructed as specified in Section 16303, "Underground Electrical Work." Conduits and ducts under roads, paved areas, and railroad tracks shall be concrete encased. No more than two 90 degree conduit bends are allowed.

Building entrance cables shall be terminated on protected entrance terminals and in a housing (when so directed) using current industry standard practice. Certain types of terminals are mounted on the outside walls of buildings. Outside terminal should be the exception and not the norm, and should only be installed on small buildings (e.g., storage sheds, small warehouses, guard gates, etc.).

NOTE: Number of copper cable pairs is requirement driven; when requirements are unknown, provide 1.5 cable pairs per 9 square meter of usable space. Gage of cable shall depend on distance and gage of existing base backbone cable. Installation of cable shall be in accordance with the Navy Base Communications Specifications, Section NCTC IOP90A, SCN 3. Install multipair copper cable to support voice, alarms, and miscellaneous low speed circuits.

Design shall provide multipair copper cable between each telecommunications closet and the telecommunications equipment room. When the telecommunications equipment is not co-located with the IDF, install a copper cable between the IDF or BDF and the equipment. The size of cable between the IDF or MDF in the telecommunications equipment

room and the IDF in the telecommunications closets shall be based on four cable pair for every potential telephone instrument or every 9 square meter 100 square feet of usable space. The riser/vertical building backbone shall have no more than two hierarchical levels of cross connects. Bridged taps are not permitted. Riser/vertical cables, as a minimum, shall meet parameters set forth in EIA/TIA-568-B.1, EIA/TIA-568-B.2, and EIA/TIA-568-B.3.

- a. Copper Backbone Cable. Install backbone copper cable between MDF, BDF, and IDF equipment as indicated on drawings.

NOTE: Single mode optical fiber cable shall be the primary base distribution backbone cable plant that transports existing and proposed data, voice, and miscellaneous circuits. The following guides shall be used for planning and installation of single mode optical fiber distribution cable:

A minimum of 12 strands of fiber media, dispersion unshifted, with a wavelength of 1310 nm shall be installed in each building. There is no standard for the core size; recommend 8/125 um or 10/125 um. Strands shall be increased as necessary to support specific requirements (e.g., command and control facilities, ADP buildings, command post, etc.).

Optical fiber cables shall be terminated on patch panels, normally track mounted. ST or SC type connectors shall be used.

Ancillary equipment (optical fiber terminals, line conditioning, channelization, backup power, etc.) for completeness shall be installed and made operational. The quantity of and type of equipment is requirement driven and this information shall be furnished by the user. When requirements cannot be validated, channel banks of sufficient size to support 1.5 circuits shall be provided for each 9 square meter 100 square feet of usable space.

- b. Optical fiber Backbone Cable. Install backbone optical fiber in indicated pathways. Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket 250 mm leaving strength members exposed for approximately 250 mm. Twist strength members together and attach to pulling eye.

3.1.1.3 Horizontal Cabling

NOTE: Choose one of the following methods for designing the horizontal cabling system. Install horizontal cables above dropped ceilings when utility columns are utilized and under floors when cables are run underneath raised floors as follows:

1. Divide usable floor space into zones of 37 to 83 square meter 400 to 900 square feet each. Run horizontal cables in the ceiling or underneath the floor leaving adequate slack in each cable so that cable can be rerouted to any user within the zone without splicing. When utility columns or floor boxes are not in place, cables shall be coiled, tagged, and left unterminated in the zone area above the ceiling or underneath the floor. The other end shall be terminated in the telecommunications closet or the telecommunications equipment room. Outlet boxes and outlet/connectors for the user shall be installed after utility columns or floor boxes are installed.]

2. Divide the usable floor space into zones of 37 to 83 square meter each. Run horizontal cable in the ceiling or underneath the floor and terminate each cable on an eight-position jack (RJ-45) in the ceiling or underneath the floor, above or below the individual zone. Connector cables shall be connected to the RJ-45's in the ceiling or underneath the raised floor using modular plugs and run to the individual workstation. Each connector cable shall have sufficient slack to reach any workstation (user) within the zone. When utility columns or floor boxes are not in place, cables shall be coiled, tagged, and left unterminated in the zone area above the ceiling or underneath the floor.]

A minimum of two spare, four pair cables shall be terminated on eight-position jacks (RJ-45) in dropped ceiling above each room. Cables are to be tagged and reserved for alarms, music, public address, sensors, etc. If easy access is available in the ceilings above adjacent rooms, then cables may be consolidated for several rooms and terminated in a central location. When a dropped ceiling is not available, and a raised floor is, then the spare cable shall be installed under the raised floor.

Design of office spaces (e.g., permanent walls, open spaces, modular partitions, etc.) shall dictate the method of routing horizontal cable from the telecommunications closet to the outlet/connector.

There are three primary means of routing cable to the user: via conduit in permanent wall, floor ducts, and open cable to utility columns. Open cables also can be routed below raised floors.

No more than three outlets shall be on a conduit run. Conduit for single outlets shall be minimum of 20 mm diameter, for two outlets minimum 25 mm, and for three outlets minimum 35 mm. Conduit bend radius shall be coordinated with cable bend radius. Conduit entries at outlet and junction boxes shall be arranged so that cables passing through the box shall enter and exit at opposite sides of the box.

No more than three, four-pair cables shall be on a 20 mm conduit run. Maximum length of horizontal UTP cable to workstation outlet shall be 90 m, this shall include the routing in the telecommunications closet.

Install horizontal cabling and pathway as indicated on drawings between [MDF,] [BDF,] [IDF,] [telecommunications closet] and telecommunications outlet assemblies at workstations.

3.1.2 Pathway Installations

Comply with TIA/EIA-569-A. Conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 150 mm away from parallel runs of electrical power equipment, flues, steam, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project. Run conduits in crawl spaces and under floor slabs as if exposed. Install no more than two 1.57 rad bends for a single horizontal cable run.

[3.1.2.1 Under Floor Duct Pathway Systems

Install cabling and under floor duct in accordance with manufacturers' recommendations.

]3.1.3 Conduit Installed Under Floor Slabs

NOTE: Refer to Section 16402, "Interior Distribution System" for additional conduit specifications. Do not use metal flex conduit for telecommunications wiring.

Conduit shall be located a minimum of [300] [_____] mm below the vapor barrier. Seal around conduits at penetrations through vapor barrier.

[3.1.4 Service Entrance Conduit, Overhead

Galvanized rigid steel from service entrance to service entrance fitting or weatherhead outside of building.

]3.1.5 Service Entrance Conduit, Underground

[PVC heavy duty type, rigid Type,] [or] [galvanized rigid steel].
Underground portion shall be encased in minimum of 75 mm of concrete extending from the building entrance to 1500 mm out from the building and shall be a minimum of 450 mm below slab or grade.

]3.1.6 Cable Tray Installation

Install cable tray components in accordance with TIA/EIA-569-A.

3.1.7 Work Area Outlets

Terminate UTP cable in accordance with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3] and wiring configuration as specified.

3.1.8 Telecommunications Closet Termination

Install termination hardware required for [Category 3] [Category 5e] [and] [Optical fiber] system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

[3.1.9 Equipment Support Frames

Install in accordance with TIA/EIA-569-A:

- [a. Bracket, wall mounted. Mount bracket to plywood backboard per manufacturer's recommendations. Mount rack so height of highest panel does not exceed 1980 mm above floor.]
- [b. Racks, floor mounted modular type. Permanently anchor rack to the floor per manufacturer's recommendations.]
- [c. Cabinets, freestanding modular type. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets. [Mount rack mounted fan in base of cabinet.]]
- [d. Cabinets, wall-mounted modular type. Mount cabinet to plywood backboard per manufacturer's recommendations. Mount cabinet so height of highest panel does not exceed 1980 mm above floor.]

]3.1.10 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07840, "Firestopping."

3.1.11 Grounding and Bonding

In accordance with TIA/EIA-607, and CEI 64-8.

3.2 TESTING

3.2.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3].

3.2.1.1 Inspection

Visually inspect cabling jacket materials to verify that the cables are CE marked or show provisions of CEI references or third party certification markings. Visually inspect UTP and optical fiber jacket materials for CE/CEI or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for tip and ring pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3], [and] [TIA/EIA-570-A]. Visually confirm [Category 3] [and] [Category 5e] marking of outlets, wall plates, outlet/connectors, and patch panels.

3.2.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after terminated but not cross connected. Perform [16 MHz attenuation test for Category 3 systems] [and] [100 MHz near end cross talk (NEXT) and attenuation tests for Category 5e systems] installations.

[Perform optical fiber end to end attenuation tests using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures.

Perform tests in accordance with TIA/EIA-526-14-A, Method B for horizontal, multimode optical fiber and TIA/EIA-526-7, Method B for backbone, single mode optical fiber. Perform verification acceptance tests and factory reel tests.]

3.2.1.3 Performance Tests

- a. Category 5e Links. Perform UTP link tests in accordance with TIA/EIA-568-B.1, [TIA/EIA-568-B.2], [TIA/EIA-568-B.3]. Tests shall include wire map, length, attenuation, NEXT, and propagation delay.
- b. Category 3 Links. Test each pair for short circuit continuity, short to ground, crosses, and reversed polarity. Include operational and ringback, and dial tone tests.
- [c. Optical fiber Links. Perform optical fiber end to end attenuation tests and reel tests at jobsite.]

3.2.1.4 Final Verification Tests

Perform verification tests for UTP [and optical fiber] systems after the complete telecommunications cabling and workstation outlet/connectors are installed. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

-- End of Section --